Course Syllabus

Syllabus CHBE 692 Fall 2019

1. Instructor: M. Robert, office number x3516, email mrobert@rice.edu
2. Office hours: by appointment
3. Lecture Time: M/W 4-5:15pm Classroom Mech Lab 254

MAIN TOPICS OF DISCUSSION:

Fourier series and applications

1. Historical development (after Fourier): steady state heat transfer in bounded regions; the method of separation of variables
2. Definition and properties of Fourier series; conditions for convergence
3. Applications to time-dependent heat transfer problems in bounded regions

Fourier integrals and applications

1. Engineering introduction: steady state heat transfer in unbounded regions
2. Definition and properties of Fourier integrals; conditions for convergence; lemma of Riemann-Lebesgue
3. Convolution theorem
4. Singular distributions; the delta “function”
5. Laplace transform
6. Applications to time-dependent heat transfer problems in unbounded regions

Complex analysis and applications

1. Complex numbers, their properties and operations
2. Complex functions; analytic functions; conformal mappings; Moebius and Schwartz-Christoffel transforms
3. Complex integration; Cauchy’s theorem; residue theory
4. Harmonic functions; Cauchy-Riemann theorem
5. Applications I: Time-independent and time-dependent heat transfer problems in varied geometries
6. Applications II: Fluid mechanics: streamlines and equipotential lines
7. Applications III: Mass transfer (diffusion) problems

Partial Differential equations and applicaitons

1. Classification; equations of the Sturm-Liouville type
2. Expansions of solutions in terms of orthonormal functions
3. Legendre polynomials; Bessel functions; Laguerre, Hermite, and Tchebicheff polynomials
4. Applications: Heat and mass transfer problems, both time-independent and time-dependent

Linear algebra and applications

1. Definition and properties of linear vector spaces
2. Matrices; inverse, adjoint, orthogonal, unitary, symmetric, and hermitian matrices
3. Determinants; trace, diagonalization, and eigenvalues
4. Solutions of homogeneous and inhomogeneous systems of linear equations; numerical applications
5. Applications: thermodynamic properties of solids (e.q., specific heat of crystals), and elastic properties of materials

- Grade policy: final grade is 50% homeworks, 50% final oral exam. The homeworks consist of half pledged and half non-pledged problems. Pledged problems are open class notes, closed books, no help given or received (Rice Honor Code), and absolutely no internet (which is typically useless, being most of the time unprofessional and unreliable). Material, other than classnotes, used for non-pledged homeworks must be referenced to. The pledge must be written on the homeworks. To successfully pass this course students must earn at least 65% of the total points available.
- Absence policy**:** class attendance is not required, but recommended.
- Required texts: none, although Wylie's "Advanced Engineering Mathematics" is recommended.
- No special materials required for the class.
- Required examinations and papers: homeworks and final exam (see point 4 above).
- Expectations regarding course work and the Rice Honor Code: see point 4.
- Any student with a disability that requires accommodation should contact the instructor and Disability Support Services.
- Classroom behavior: no late arrivals or leaving before the end of the class. Absolutely no cell phones, laptops, tablets, or other gadgets, except if taking course notes. Absolutely no food, no drinks, no sleeping. Professional behavior is required, including dresscode, and violations of any of these rules will lead to the student having to leave the classroom at once.
- This above information is subject to change with reasonable advance notice, as deemed appropriate by the instructor.